Silicon N-Channel Power MOSFET

CS20N60 A8H

V_{DSS}	600	V
I_D	20	A
$P_D(T_C=25℃)$	250	W
$R_{DS(ON)Typ}$	0.36	Ω

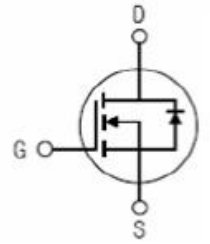
General Description：

CS20N60 A8H, the silicon N-channel Enhanced VDMOSFETs, is obtained by the self-aligned planar Technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is TO-220AB, which accords with the RoHS standard..

TO-220AB

1.Gate 2. Drain 3. Source

Inner Equivalent Principium Chart



Features：

- **Fast Switching**
- **Low ON Resistance(Rdson≤0.45Ω)**
- **Low Gate Charge (Typical Data:61nC)**
- **Low Reverse transfer capacitances(Typical: 20pF)**
- **100% Single Pulse avalanche energy Test**

Applications：

Power switch circuit of adaptor and charger.

Absolute（Tc= 25℃ unless otherwise specified）：

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	600	V
I_D	Continuous Drain Current	20	A
	Continuous Drain Current T_C = 100 °C	14	A
I_{DM} [a1]	Pulsed Drain Current	80	A
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS} [a2]	Single Pulse Avalanche Energy	1200	mJ
E_{AR} [a1]	Avalanche Energy ,Repetitive	100	mJ
I_{AR} [a1]	Avalanche Current	4.5	A
dv/dt [a3]	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	250	W
	Derating Factor above 25°C	2.0	W/℃
T_J， T_{stg}	Operating Junction and Storage Temperature Range	150，–55 to 150	℃
T_L	MaximumTemperature for Soldering	300	℃

Electrical Characteristics（Tc= 25℃ unless otherwise specified）：

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{DSS}	Drain to Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	600	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	ID=250uA,Reference25℃	--	0.65	--	V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 600V, V_{GS}= 0V, T_a = 25℃	--	--	1	μA
		V_{DS} =480V, V_{GS}= 0V, T_a = 125℃			100	
$I_{GSS(F)}$	Gate to Source Forward Leakage	V_{GS}= 30V	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	V_{GS} =-30V	--	--	-100	nA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	V_{GS}=10V,I_D=10A	--	0.36	0.45	Ω
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	2.0	--	4.0	V
Pulse width tp≤380μs, δ ≤2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
g_{fs}	Forward Transconductance	V_{DS}=15V, I_D =10A	--	17	--	S
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1.0MHz	--	2847		pF
C_{oss}	Output Capacitance		--	252		
C_{rss}	Reverse Transfer Capacitance		--	20		

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D =20A V_{DD} = 300V R_G = 25Ω	--	36		ns
tr	Rise Time		--	73		
$t_{d(OFF)}$	Turn-Off Delay Time		--	166		
t_f	Fall Time		--	73		
Q_g	Total Gate Charge	I_D =20A V_{DD} =300V V_{GS} = 10V	--	61		nC
Q_{gs}	Gate to Source Charge		--	14	--	
Q_{gd}	Gate to Drain (“Miller”)Charge		--	24	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	20	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	80	A
V_{SD}	Diode Forward Voltage	I_S=20A,V_{GS}=0V	--	--	1.5	V
trr	Reverse Recovery Time	I_S=20A,T_j = 25° C	--	425	--	ns
Qrr	Reverse Recovery Charge	dI_F/dt=100A/us, V_{GS}=0V	--	3.7	--	μC
Pulse width tp≤380μs, δ ≤2%						

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	0.5	℃/W
$R_{\theta JA}$	Junction-to-Ambient	62	℃/W

[a1]: Repetitive rating; pulse width limited by maximum junction temperature
[a2]: L=10mH, I_D=15.5A, Start T_J=25℃
[a3]: I_{SD} =20A,di/dt ≤200A/us,V_{DD}≤$BV_{DSS,}$ Start T_J=25℃

Characteristics Curve:

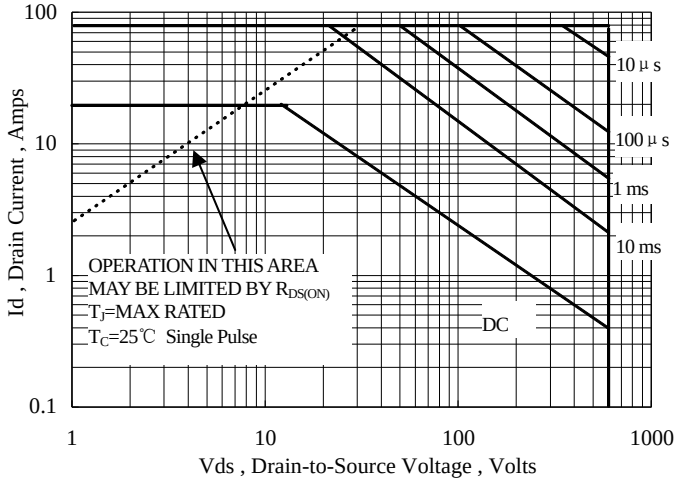


Figure 1 Maximun Forward Bias Safe Operating Area

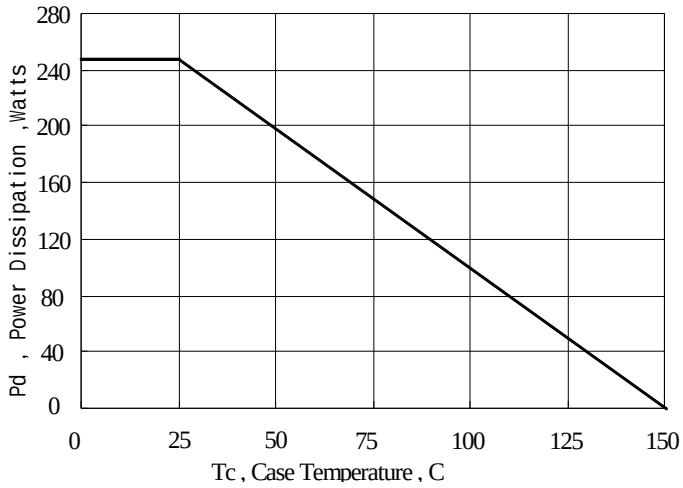


Figure 2 Maximun Power Dissipation vs Case Temperature

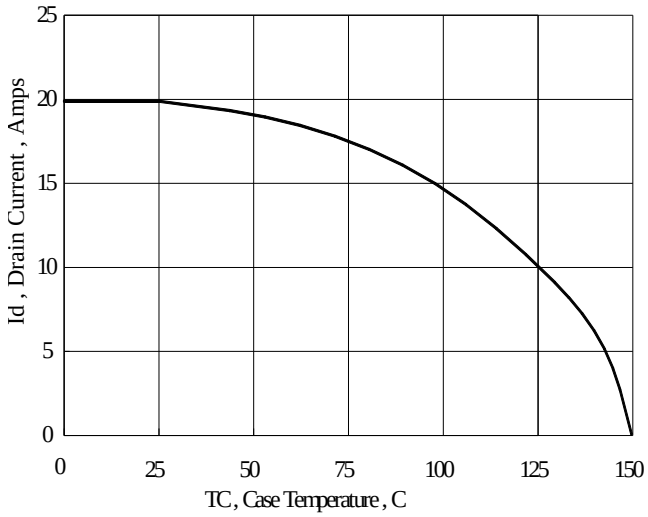


Figure 3 Maximum Continuous Drain Current vs Case Temperature

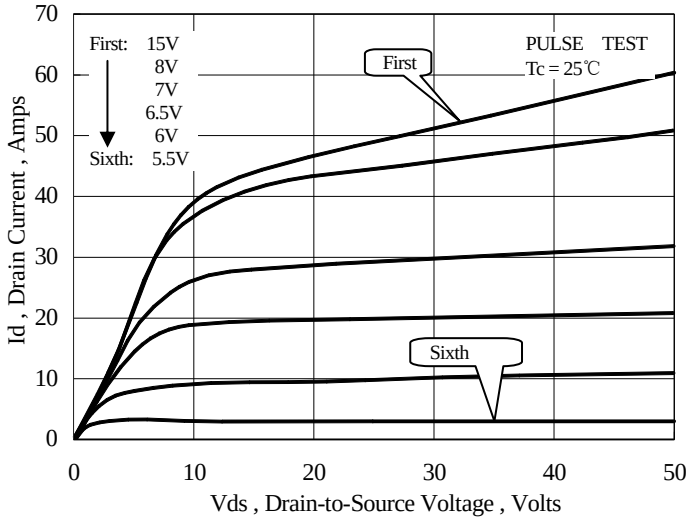


Figure 4 Typical Output Characteristics

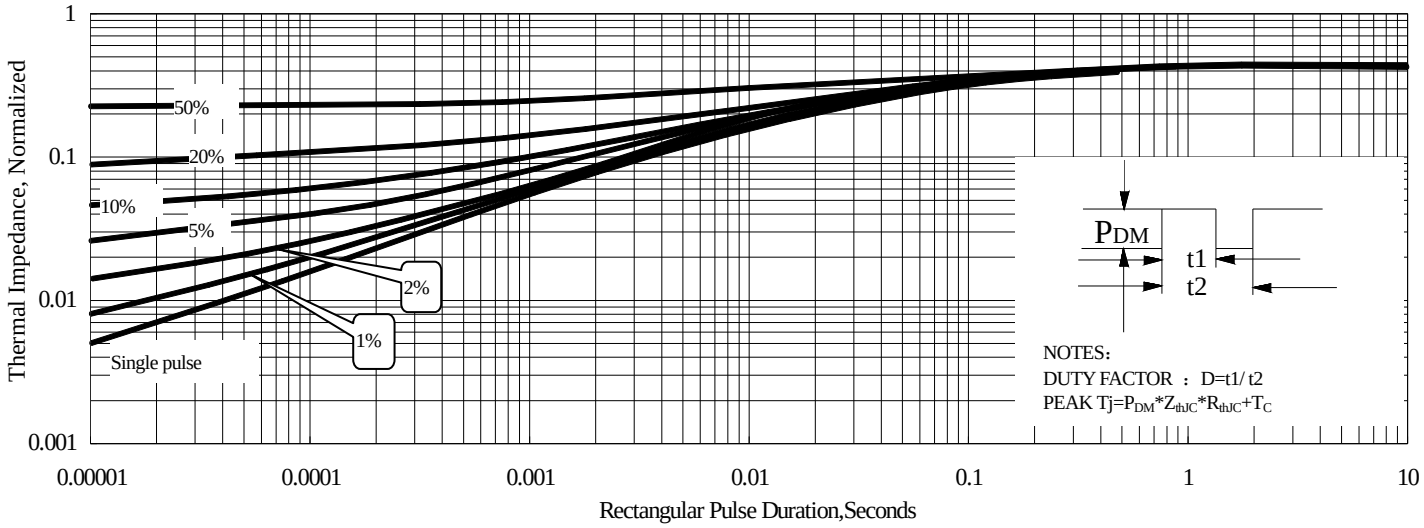


Figure 5 Maximum Effective Thermal Impendance , Junction to Case

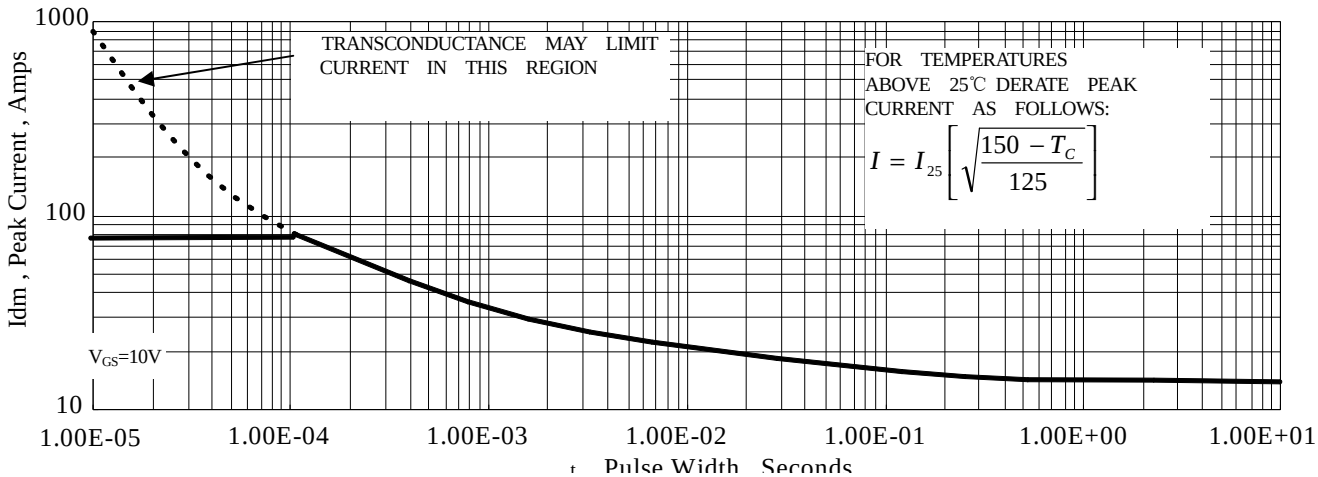


Figure 6 Maximun Peak Current Capability

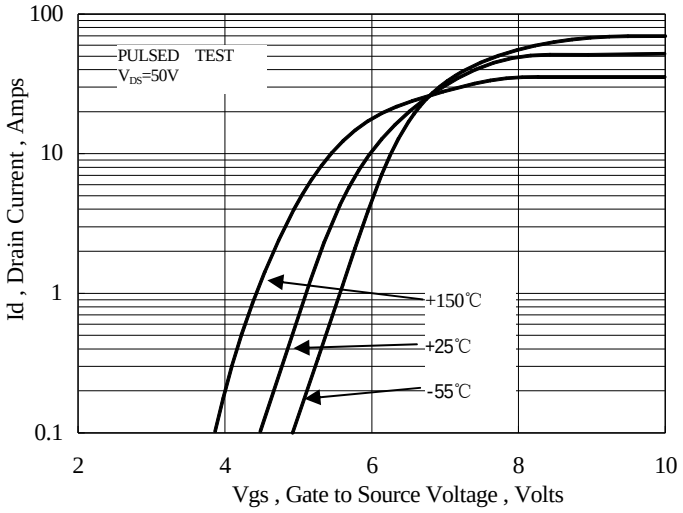


Figure 7 Typical Transfer Characteristics

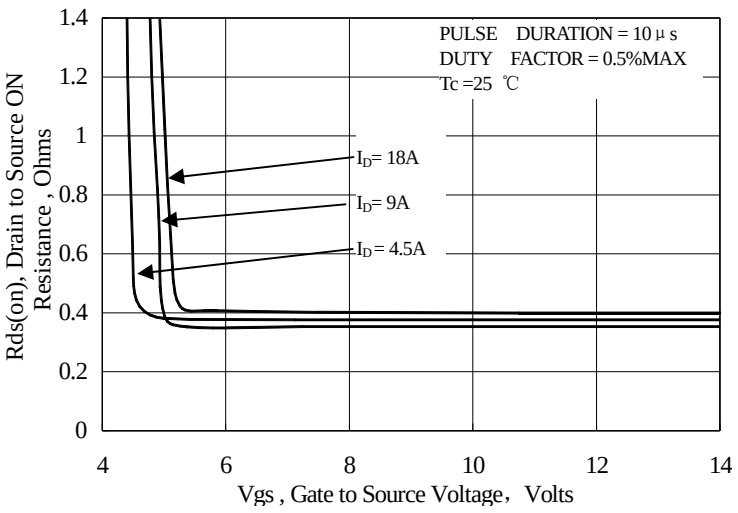


Figure 8 Typical Drain to Source ON Resistance vs Gate Voltage and Drain Current

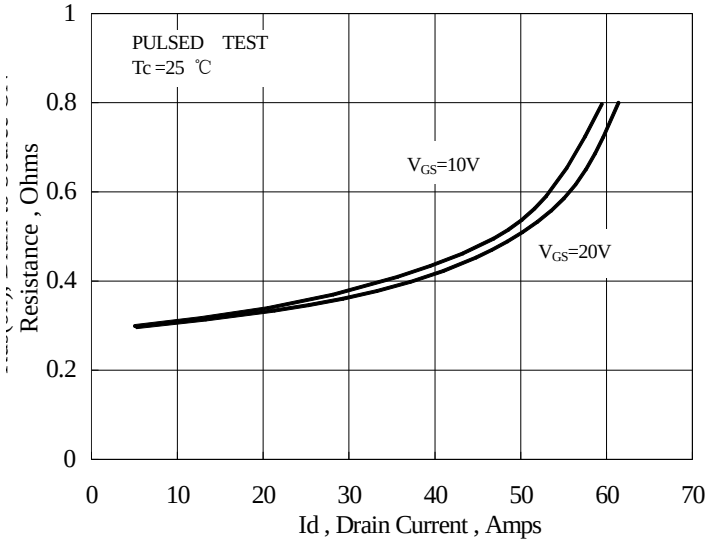


Figure 9 Typical Drain to Source ON Resistance vs Drain Current

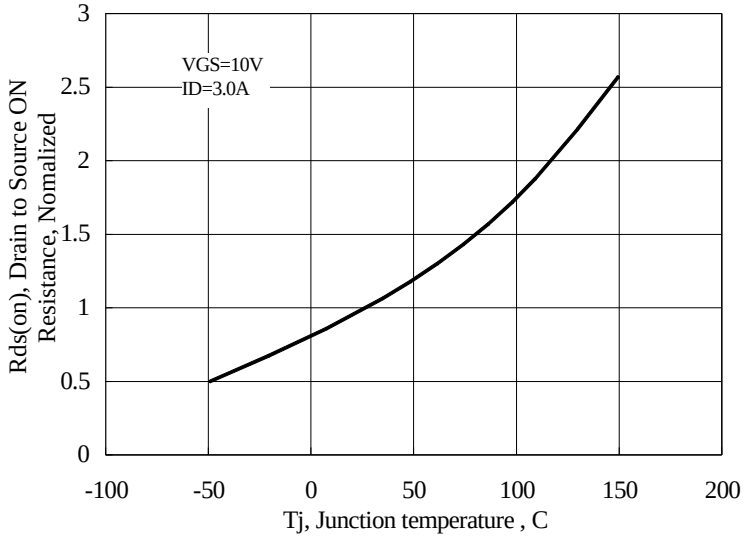


Figure 10 Typical Drian to Source on Resistance vs Junction Temperature

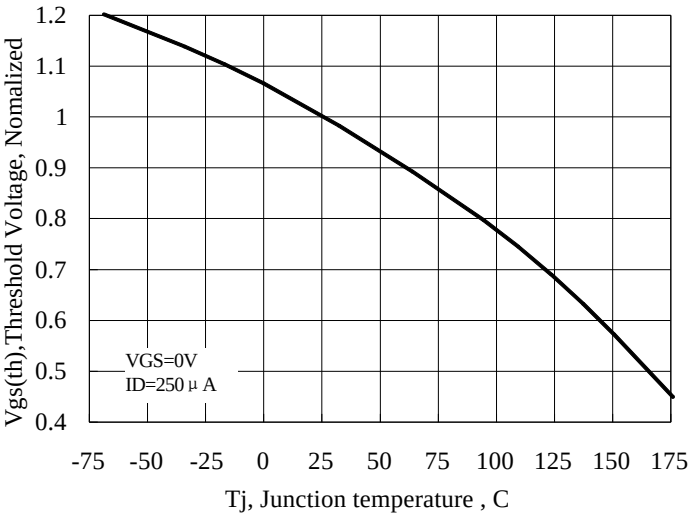


Figure 11 Typical Theshold Voltage vs Junction Temperature

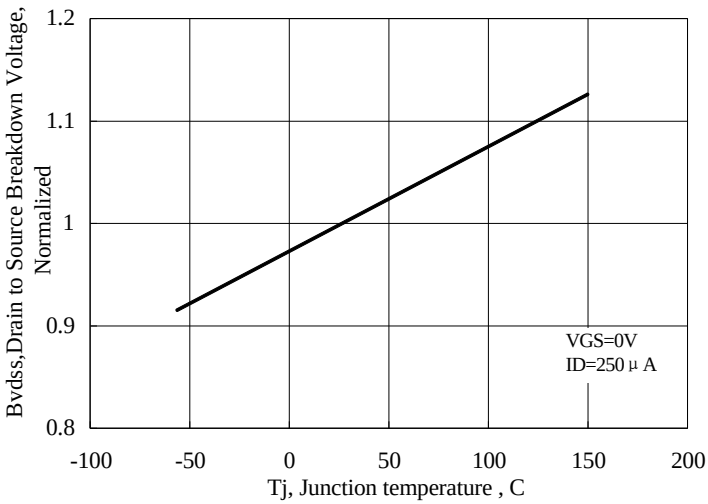


Figure 12 Typical Breakdown Voltage vs Junction Temperature

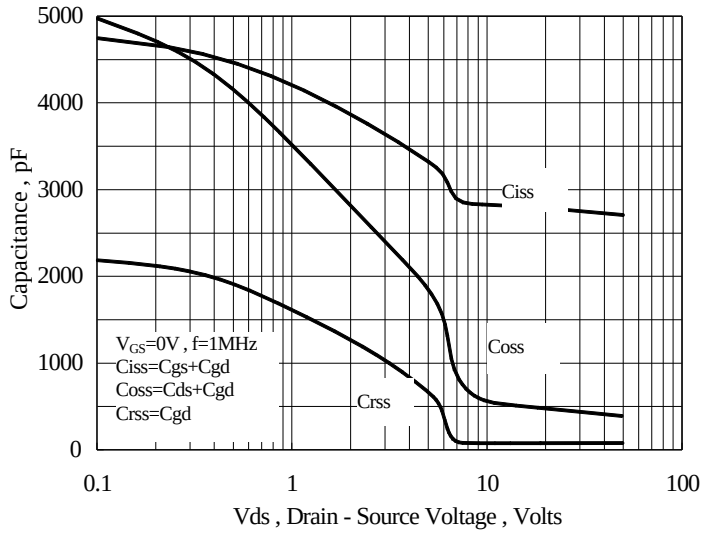


Figure 13 Typical Capacitance vs Drain to Source Voltage

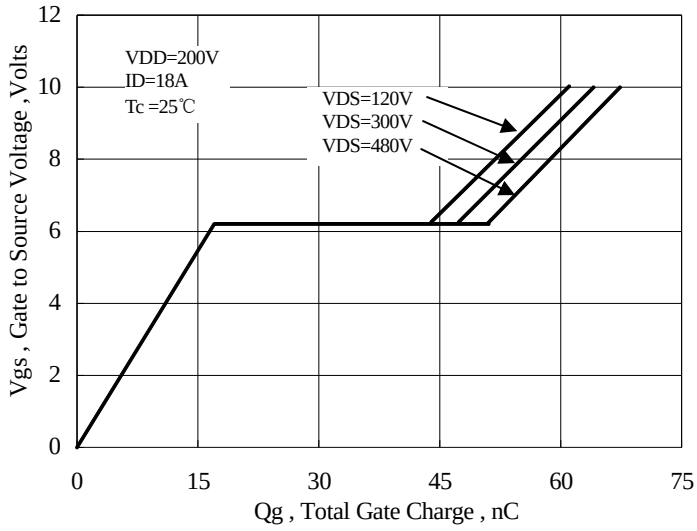


Figure 14 Typical Gate Charge vs Gate to Source Voltage

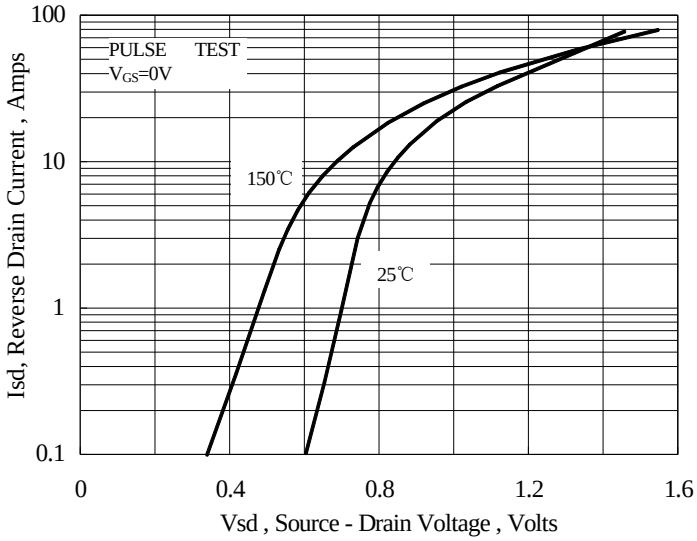


Figure 15 Typical Body Diode Transfer Characteristics

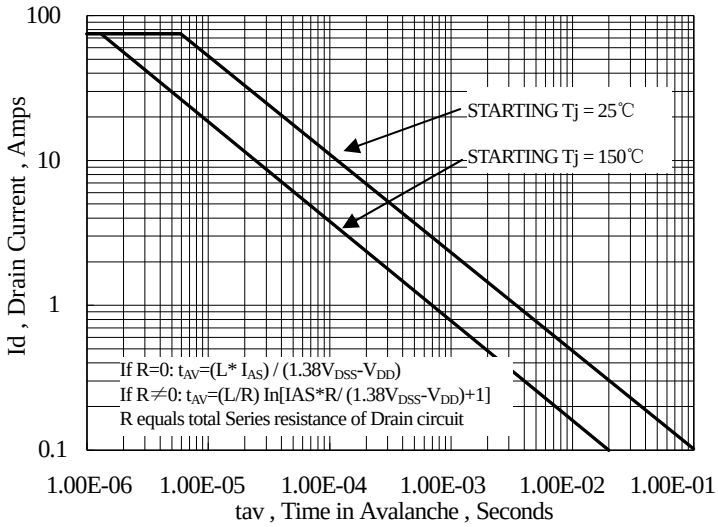


Figure 16 Unclamped Inductive Switching Capability

TestCircuitandWaveform

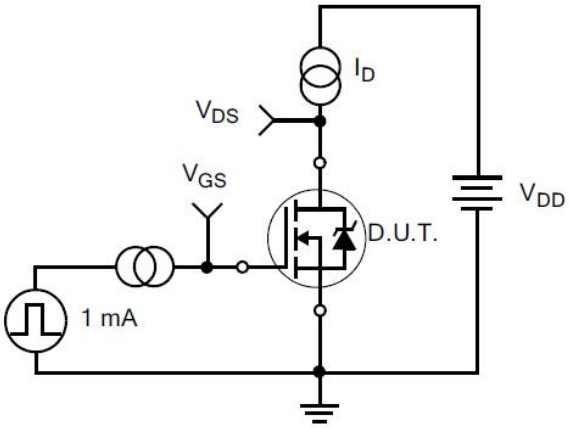


Figure 17. Gate Charge Test Circuit

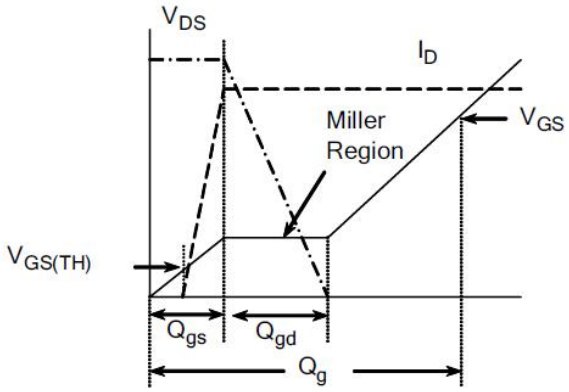


Figure 18. Gate Charge Waveform

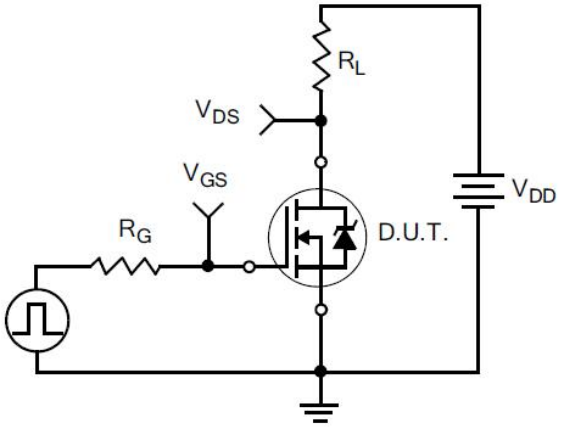


Figure 19. Resistive Switching Test Circuit

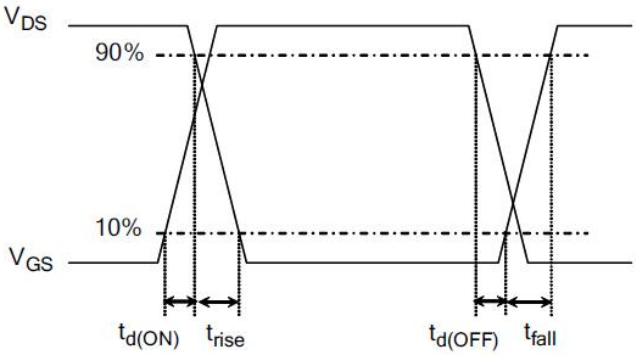


Figure 20. Resistive Switching Waveforms

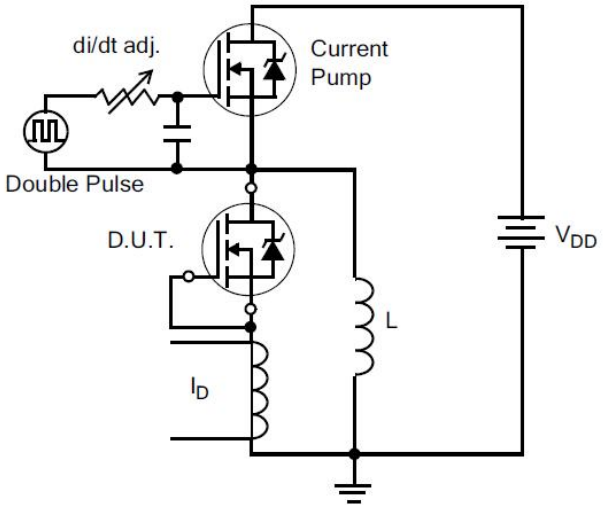


Figure 21. Diode Reverse Recovery Test Circuit

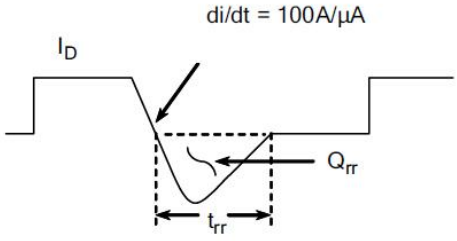


Figure 22. Diode Reverse Recovery Waveform

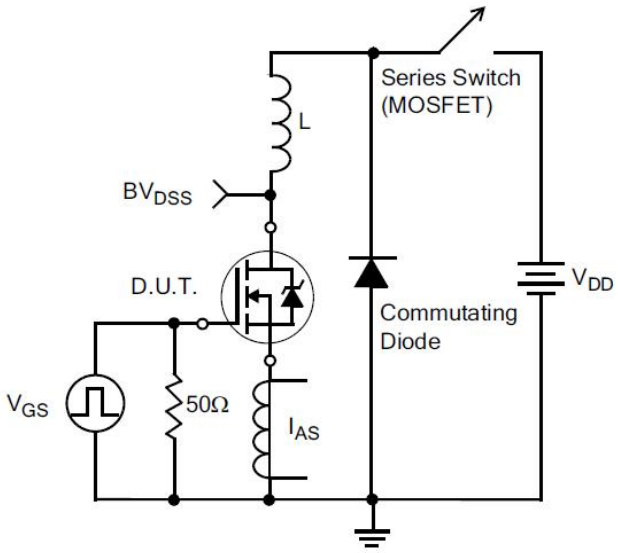
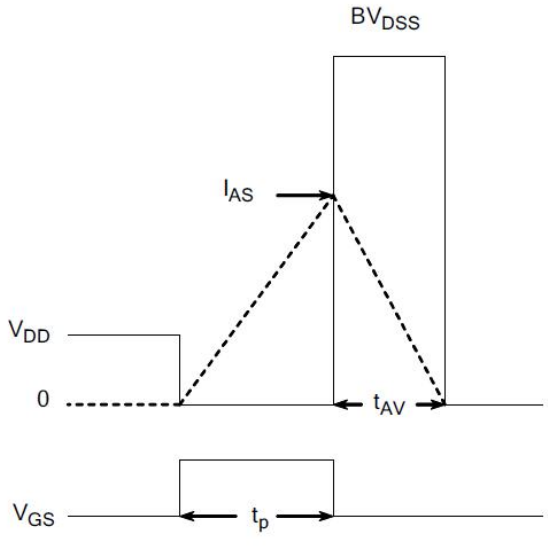


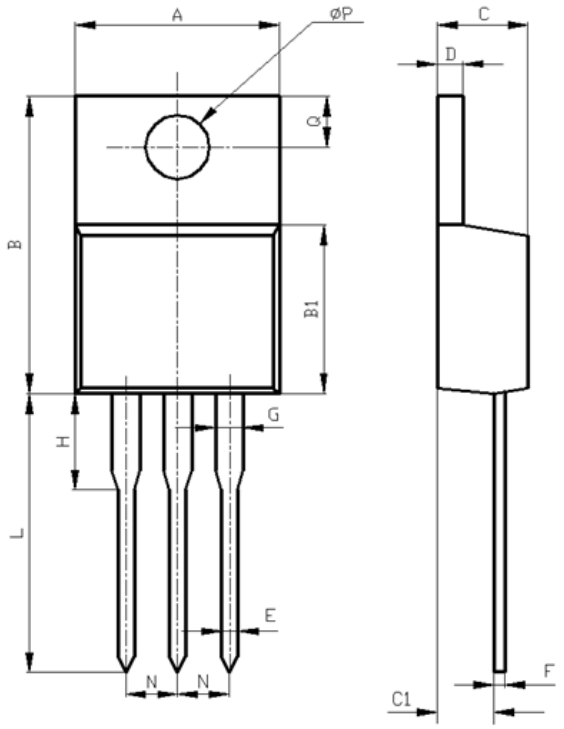
Figure 23. Unclamped Inductive Switching Test Circuit



$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

Figure 24. Unclamped Inductive Switching Waveforms

Package Information:



Items	Values(mm)	
	MIN	MAX
A	10.10	10.50
B	15.0	16.0
B1	8.90	9.50
C	4.30	4.80
C1	2.30	3.00
D	1.20	1.40
E	0.70	0.90
F	0.35	0.55
G	1.17	1.37
H	3.30	3.80
L	12.70	14.70
N	2.34	2.74
Q	2.40	3.00
ΦP	3.70	3.90

TO-220AB Package

The name and content of poisonous and harmful material in products

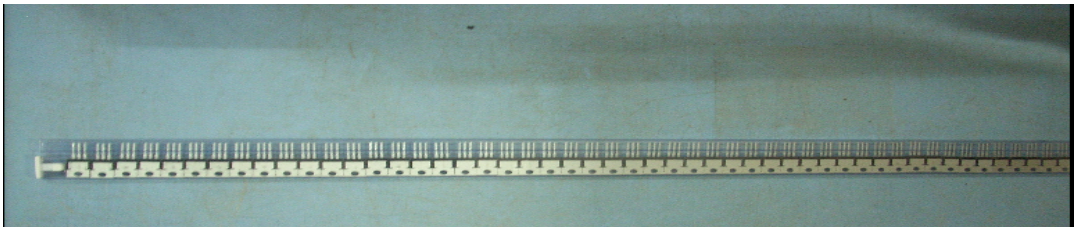
Part's Name	Hazardous Substance					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
Limit	≤0.1%	≤0.1%	≤0.01%	≤0.1%	≤0.1%	≤0.1%
Lead Frame	○	○	○	○	○	○
Molding Compound	○	○	○	○	○	○
Chip	○	○	○	○	○	○
Wire Bonding	○	○	○	○	○	○
Solder	×	○	○	○	○	○
Note	○: means the hazardous material is under the criterion of SJ/T11363-2006. ×: means the hazardous material exceeds the criterion of SJ/T11363-2006. The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS.					

Warnings

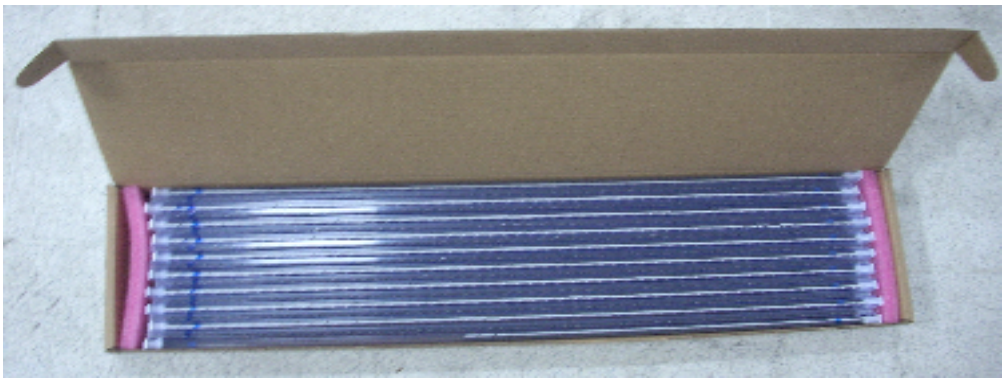
1. Exceeding the maximun ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximun ratings of the device.
2. When installing the heatsink, please pay attention to the torsional moment and the smoothness of the heatsink.
3. VDMOSFETs is the device which is sensitive to the static electricity, it is necessory to protect the device from being damaged by the static electricity when using it.
4. This publication is made by Huajing Microelectronics and subject to regular change without notice.

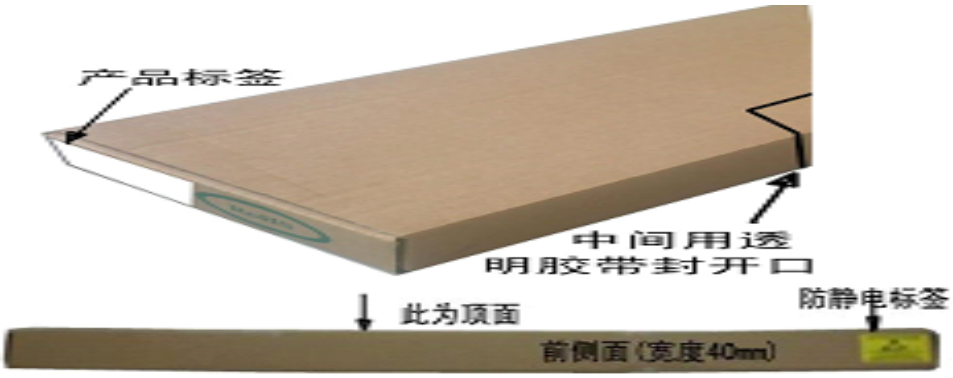
CS20N60A8H包装示意图

1、将测试好的管子装入料条中，一条料条可以装入50只管子，从料管顶面俯视，产品管脚朝向料管上方，塑封体正印面朝向料管印字面，料管两侧均为白色硬塞，如下图：



2、将料条装入中包装盒（内尺寸：585×148×38㎜）中，一个中包装盒子可以装入20条料条（1个中包装盒子（1层，5盒），如下图：

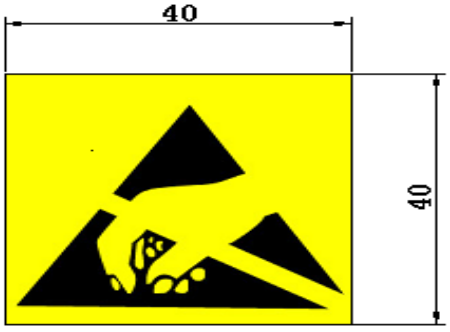




(1)在内盒左侧面贴产品标签，注意避让 RoHS、REACH标识部分，用透明胶带在内盒中间封住开口。

(2)产品的包装盒上要有防静电标志。将防静电标志标贴，贴在包装盒正面的右边,距边缘 5㎜处。
（如果包装盒上已印有防静电标志，则不需要贴）

(3)防静电标签示意图：

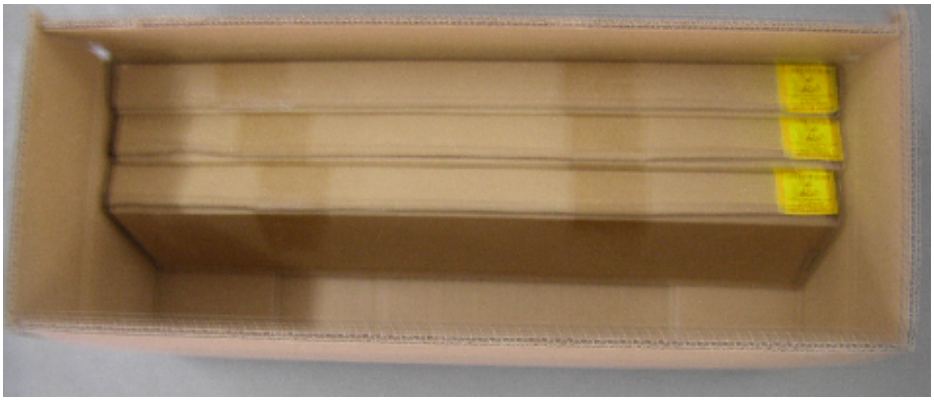


(4)产品标签示意图：（长×宽：80 ㎜×38㎜）

（标签A处示情况为 或 ）

REACH标签：尺寸：16 ㎜×10㎜，采用隐形印刷
色标：C：100 M：0 Y：100 K：0
RoHS标签：尺寸：16 ㎜×10㎜
色标：C：100 M：0 Y：100 K：0
尺寸：外直径9㎜
色标：C：0，M：90，Y：80，K：0
用于含铅焊料装片产品
尺寸：外直径9㎜
色标：C：100，M：0，Y：100，K：0
用于无铅焊料装片或共晶焊装片产品

3、将中包装盒装入大包装盒(5号箱,内尺寸：605×227×175㎜)中，一个大包装盒子可以装入5个中包装盒子（1层，5盒），如下图：



4、首盒或尾盒中放入装箱单，包封，如下图：

5、在包装箱图示位置贴产品标签，发货标签距紧邻的两侧面各一指宽
用透明宽胶带以“H”型封口，并用白色打包带打包，打包力度适中，避免打包带嵌进箱体

编号规则

尊敬的客户：

针对我公司VDMOS产品的命名规则通告贵司：

1、产品命名为:CS20N60A8H

CS 20N60 A 8 H

- H 表示第二代工艺
- 8 代表封装形式(如：1代表封装形式为TO-92；6代表封装形式为TO-126；8代表封装形式为TO-220AB；9代表封装形式为TO-220F)
- A 代表与芯片相关的信息
- 20N60 表示600V/20A
- CS 表示MOSFET

华润华晶微电子公司产品与技术中心